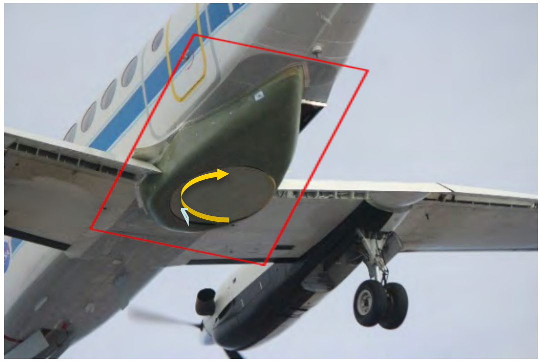
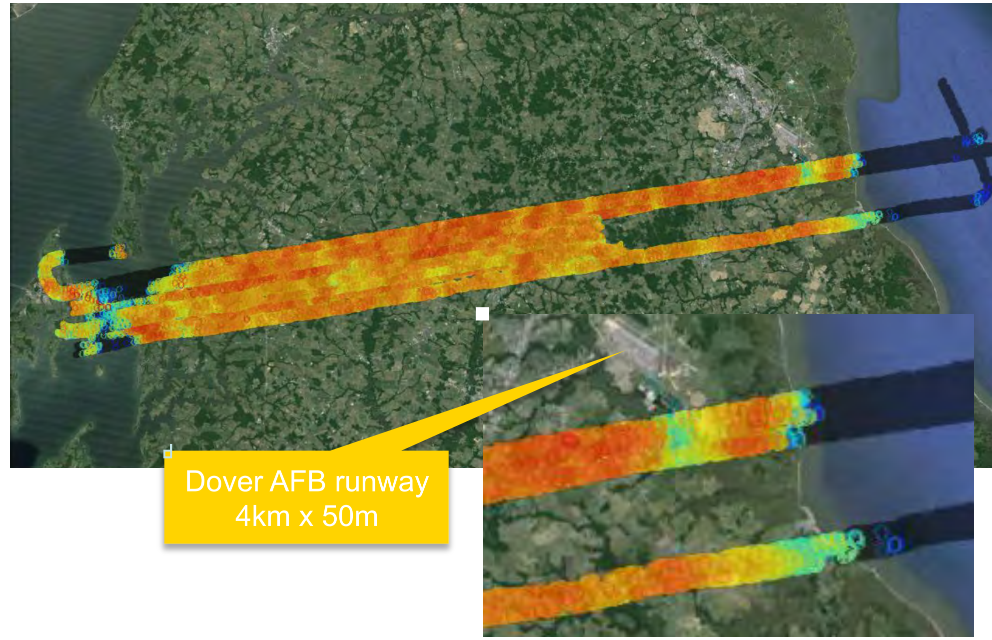
Goddard's new airborne SMAP simulator-- the Scanning L-band Active Passive (SLAP)--conducts first test flights in preparation for SMAP cal/val

Alicia Joseph, Edward Kim, Hemanshu Patel, Tammy Faulkner, Albert Wu– GSFC/617
USDA-Beltsville, MD





Goddard's new airborne imager, the Scanning L-band Active Passive (SLAP) instrument flew its first test flights in December, 2013 in Eastern Shore, MD in preparation for SMAP's post-launch calibration/ validation activities.

Name: Alicia Joseph, NASA/GSFC, Code 617
E-mail: Alicia.T.Joseph@nasa.gov
Phone: 301-614-5804

Abstract: Goddard's new airborne imager, the Scanning L-band Active Passive (SLAP) instrument flew its first test flights in December, 2013 in Eastern Shore, MD in preparation for SMAP's post-launch calibration/validation activities. SLAP comprises of a fully polarimetric L-band radiometer and fully polarimetric L-band radar with a shared antenna. The SLAP airborne/ground campaign was designed to conduct flight testing of an airborne instrument.

References:

SMAP L2_SM_P ATBD

Data Sources: Passive and active L-band microwave data from SLAP airborne instrument. Aircraft Flight dates 12/16/2013 and 12/18/2013 from NASA Langley over Eastern Shore, MD.

Technical Description of Figures:

Figure 1 (top left) Bottom view of SLAP (in red box) on NASA Langley's King Air (UC-12) aircraft.

Figure 2 (top right) Maryland Eastern shore, December 2013, same flight lines as SMAPVEX'08, modified by ATC near Dover AFB. Two flights in one day (high resolution flight shown) 1st flight: low altitude (2000 ft. AGL), high resolution (260m). Flight lines ~80km long; 1.4km wide swaths.

Figure 3 (bottom right) Ground truth surveyors from NASA/GSFC Code 617 and USDA taking soil moisture, surface temperature and surface roughness measurements simultaneous to SLAP's overpass. ComRad Microwave truck took measurements on the same fields in 2008 during SMAPVEX'08.

Scientific significance:

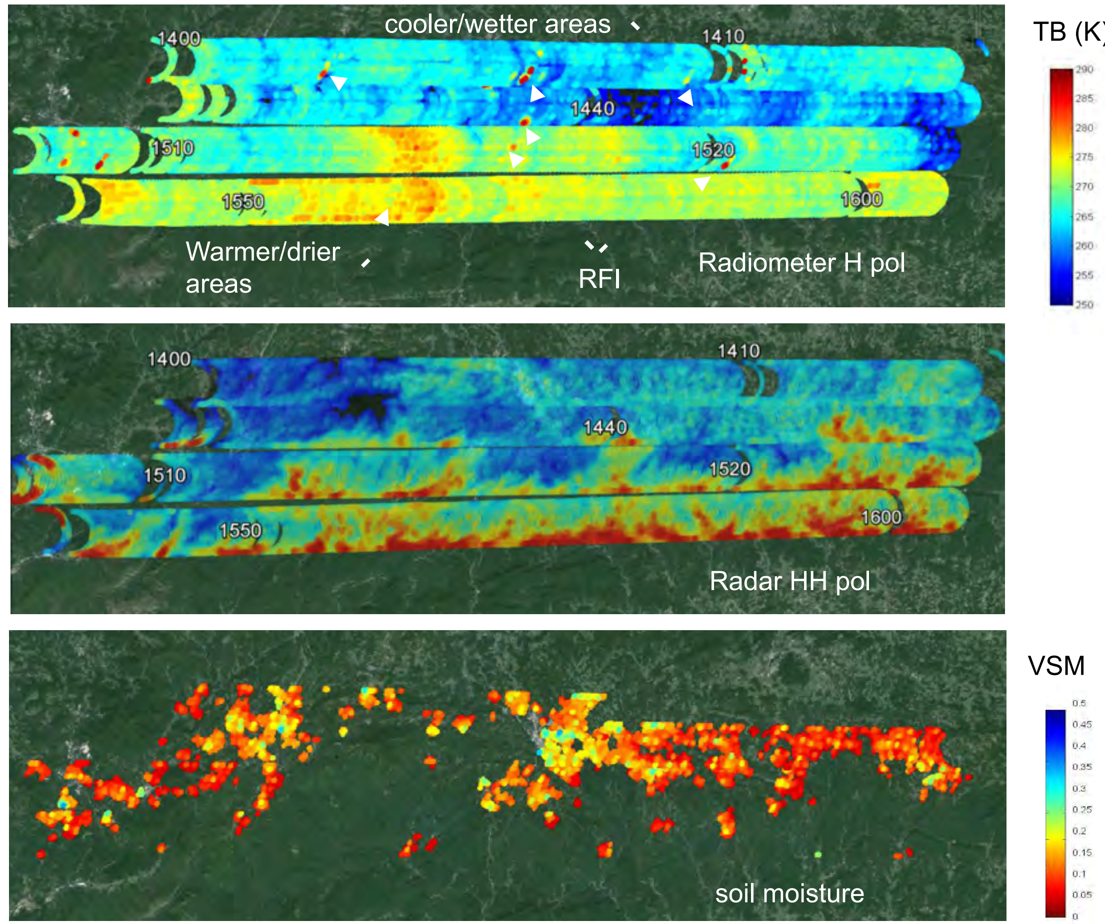
We conduct an aircraft validation experiment where the new SLAP instrument flew two flight lines (low altitude and high resolution). In conjunction with the aircraft, there was in-situ ground sampling. Soil moisture sampling included concurrent observations of agricultural fields using Theta probes. We characterized soil moisture for all fields within an area (block) large enough to include several aircraft footprint. challenging conditions for soil moisture retrieval was frozen ground. Ongoing analyses will compare soil moisture retrieved by SLAP to ground truth measurements. Upon final completion of all instrument and data calibration observations will be combined to test advanced soil moisture algorithms. The results will be used to help improve soil moisture retrievals for SMAP. Future plans are to fly SLAP in combination with ComRad without frozen ground conditions.

Relevance for future science and relationship to Decadal Survey:

SLAP contributes to the NASA's core mission because it is an airborne simulator for the SMAP (Soil Moisture Active Passive) satellite mission, one of NASA's flagship missions scheduled to launch in January 2015. SLAP is supported by NASA HQ as a unique calibration/validation tool for SMAP. SMAP's Calibration/validation activities will benefit from higher resolution observations obtained from the SLAP instrument. SLAP can provide the core observations for SMAP's planned 2015 & 2016 cal./val. campaigns, as well as soil moisture and ecological data for programs such as the Arctic Boreal Vulnerability Experiment (*ABoVE*). SLAP combined with GSFC's Ground based Microwave truck (ComRad) can provide excellent cal./val. capabilities for SMAP.

Goddard's new airborne SMAP simulator-- the Scanning L-band Active Passive (SLAP)--conducts first science flights in preparation for SMAP cal/val

Edward Kim, Hemanshu Patel, Tammy Faulkner, Albert Wu, Alicia Joseph– GSFC/617
Duke University, USDA-Beltsville, MD
LaRC Research Services Directorate & Spectrum Management Office



Goddard's new airborne imager, the Scanning L-band Active Passive (SLAP) instrument flew its first science flights in May, 2014 in North Carolina in preparation for SMAP post-launch calibration/validation activities that are scheduled to begin in 2015.

Name: Edward Kim, NASA/GSFC, Code 617
E-mail: ed.kim@nasa.gov
Phone: 301-614-5653

Abstract: Goddard's new airborne imager, the Scanning L-band Active Passive (SLAP) instrument flew its first science flights in May, 2014 in North Carolina in preparation for SMAP post-launch calibration/validation activities that are scheduled to begin in 2015. Coincident passive and active imagery demonstrates SLAP's sensitivity to varying surface conditions, forest cover, and topography, just as will be needed for the cal/val activities. Soil moisture was retrieved using the SMAP Level 2 passive algorithm.

References:

SMAP L2_SM_P ATBD

Data Sources: Passive and active L-band microwave data from SLAP airborne instrument overlaid on a Google Earth background. Aircraft Flight date 5/21/2014 from NASA Langley. Soil moisture calculated with SMAP L2_SM_P algorithm with MODIS 500m landcover and land surface temperature data.

Technical Description of Figures:

Figure 1 (top) SLAP (in red box) on NASA Langley's UC-12 King Air.

Figure 2 (top) H-polarized brightness temperature (TB) image for 20x100 km primary science target region observed during May 2014 science flights in North Carolina. Cooler TBs (blues & greens) are colder/wetter areas while warmer TBs (reds & oranges) are hotter/drier areas. Isolated red spots are manmade radio frequency interference (RFI). Numbers indicate local times during flight lines.

Figure 2 (middle) HH-polarization backscatter coefficient image from the SLAP radar. Lower 2 flight lines are on sloped terrain as seen by cross-track variation in reflection strength (red to blue). Upper 2 flight lines are also in hilly terrain but without the large-scale slope, resulting in less variation.

Figure 2 (bottom) soil moisture for non-forested pixels, retrieved from SLAP radiometer observations using the SMAP level2 passive algorithm.

Scientific significance:
These images are examples of SLAP passive and active observations at 800m median resolution over a site in western North Carolina. The area includes strong topography as well as forests—challenging conditions for soil moisture retrieval, and a great test of SLAP. The warmer TBs (red & orange) in Fig 2 (top) are from lower-elevation, more forested areas and later in the day, whereas the cooler TBs (blue & green) are from higher-elevation areas and earlier in the day—demonstrating SLAP's high sensitivity to factors that control TBs. Ongoing analyses will compare soil moisture retrieved by SLAP to ground truth taken by Dr, Ana Barros' team from Duke University. Following final radar calibration, active and passive observations will be combined to test advanced soil moisture algorithms. The results will be used to help improve soil moisture retrievals for SMAP and, by extension, all science areas that would benefit from improved soil moisture data.

Relevance for future science and relationship to Decadal Survey:
Calibration/validation of NASA's flagship SMAP mission—set to launch by early CY2015—will benefit from the much-higher resolution observations obtainable from aircraft simulators like Goddard's SLAP instrument. SLAP can provide the core observations for SMAP's planned 2015 & 2016 cal/val campaigns, as well as soil moisture and ecological data for programs such as the Arctic Boreal Vulnerability Experiment (*ABoVE*). SLAP is also ideal for new ice sheet discovery science (e.g., sub-glacial lakes) that requires an airborne L-band imager.